Research Note

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RESULTS OF DIRECT SEEDING OF PONDEROSA PINE IN THE NORTHERN ROCKY MOUNTAIN REGION 1/

Results of three field experiments and one larger scale application in direct seeding of ponderosa pine show that artificial seeding is a possible method of securing ponderosa pine reproduction but that many details of its practical application remain to be worked out. First- and second-year results of a preliminary experiment, previously reported by Schopmeyer 2,3/, pointed out that: excellent germination of ponderosa pine took place under conical wire screens, poor germination occurred without screens, fall sowing resulted in better stocking than spring sowing, and cultivation of ground prior to sowing was not necessary, at least on recent burns. This note gives third-year results of the preliminary test as well as results of two other experiments and one larger scale application in seeding ponderosa pine conducted by the Northern Rocky Mountain Forest and Range Experiment Station in cooperation with the Northern Region Office of Planting of the Forest Service.

1/ By D. G. McKeever, Division of Silviculture.

2/ Schopmeyer, C. S. Direct seeding in the western white pine type. Applied Forestry Notes no. 90. Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana. May 1939.

3/ Schopmeyer, C. S. Second-year results of direct-seeding experiments in the western white pine type using screens for rodent control. Research Note no. 6. Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana. May 1940.

Description of Direct Seeding Tests

The first of recent tests of ponderosa pine seeding consisted of two plots sown in the fall of 1937 on a freshly broadcast-burned flat in the Kalispell Creek drainage of the Kaniksu National Forest, Washington. Each of these plots contained 144 screened and 144 unprotected ponderosa pine spots, in each of which approximately 20 seeds were to have been covered with 3/8-inch of mineral soil. However, as a result of generosity by the CCC enrollees who did the sowing, many spots received more than 20 seeds. In the early part of the first growing season all spots containing excessive seedlings were thinned to 15 seedlings.

The second test is located on a north-facing slope, Ellis Creek drainage, Lolo National Forest, Montana. Here nine sample plots spaced 100 feet apart in a 3 x 3 arrangement were seeded with ponderosa pine in November 1939. Each plot consisted of 25 spots spaced 6 feet apart in 5 x 5 arrangement with 20 seeds sown per spot. All spots were protected by conical screens made from hardware cloth until May 1940, when half of the screens were removed. The remaining screens were removed in September 1940. This site, with rocky silt loam soil, was logged about 1915, burned over, and now supports only occasional young Douglas-fir, sparse grass, and a few shrubs. Planting of ponderosa pine on the site has been a failure.

The third test is near Little Blue lookout tower, Ninemile Creek drainage, Lolo National Forest, Montana. Nine sample plots were seeded here with ponderosa pine in September 1940. The arrangement was similar to the Ellis Creek plots except that two blocks of 25 spots each were sown side by side at each plot. One block of 25 spots in each plot was covered with 3-mesh screens which were removed in May 1941 when germination was counted. The other blocks of 25 spots each were protected by 6-mesh screens which were not removed until October 1941. This severe ponderosa pine site is a south slope with rocky silt loam soil. It was logged about 1915, burned over, and now supports only patches of grass, herbs, and shrubs, upon which cattle forage. Planting of ponderosa pine on the area has been unsatisfactory.

The first of the above experiments demonstrated that ponderosa pine could be seeded successfully on selected sites if rodents were held in check. Other experiments 4/ illustrated that seed-eating chipmunks and mice could be controlled by a poisoning method developed by the Wildlife Research Laboratory of the Fish and Wildlife Service. This method consisted of two

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4/ Schopmeyer, C. S. Successful forestation by direct seeding using poisons for rodent control. Research Note no. 1. Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana. January 1940.

operations. First, 10 to 14 days before sowing, the area to be seeded was poisoned with hulled sunflower seeds, treated with thallium sulphate, by distributing the poison bait where rodents could readily find it in small piles at intervals of 15 to 20 feet under cover of down timber and other debris to protect seed-eating birds from it. Second, the pine seeds to be sown were coated a few days before sowing with a poisonous mixture[5/] consisting of yellow dextrine, plaster of paris, cornmeal, and strychnine alkaloid.[6/]

Using the poisoning method recommended by the Fish and Wildlife Service, 40 acres in upper Bimerick Creek drainage, Nezperce National Forest, Idaho, were seeded with ponderosa pine in October 1940 as an administrative job using CCC labor. Seed was sown in spots at the rate of 15 seeds per spot and 700 spots per acre. Nine systematically distributed sample plots of 25 crew-sown spots each were installed to count germination and survival. As a check, 25 additional spots at each plot were protected with conical screens until September to give a comparison between protected and unprotected spots. This area had been burned severely in 1934 and was covered at the time of sowing with dense brush, consisting mostly of Ceanothus velutinus. Soil is silt loam without much small rock but with outcroppings of granite. Exposure is principally south and southeast but with gentle slopes of other aspects resulting from small draws. The drainage is being planted with ponderosa pine and Engelmann spruce.

Results of Tests

Germination and survival on the four areas are listed in table 1. In this table "stocked spots" means the number of spots which had one or more live seedlings, expressed as a percentage of the total number sown. Under "seedlings per stocked spot," the average number of seedlings per spot for all the stocked spots is listed.

Table 1 shows a reasonably high percentage of success on all locations at the end of the first growing season for those spots which were screened during the first year. On the Kalispell Creek location at the end of the second and third years, formerly screened spots were 100 and 99 percent stocked, respectively. Stocking of unscreened Kalispell spots was unsatisfactory. This test showed principally that successful seeding of ponderosa pine is not probable unless rodents are controlled.

5/ Experiments have indicated that this secondary poisoning treatment is unnecessary when the prepoisoning treatment is used. Also, under some conditions the coated pine seeds lose their viability. This has led the Fish and Wildlife Service to withhold recommendations for poison coating of pine seed until further studies have been made.

6/ Warning: Thallium sulphate and strychnine alkaloid are dangerous poisons and should not be handled except according to specific instructions; formulae for mixing these poisons and directions for their use are available upon application to the Fish and Wildlife Service.

Table 1.--Germination and survival on four ponderosa pine seeded areas

Area Location	Germination		Survival					
			First Year		Second Year		Third Year	
	Stocked spots	Seedlings per stocked spot	Stocked spots	Seedlings per stocked spot	Stocked spots	Seedlings per stocked spot	Stocked spots	Seedlings per stocked spot
	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Kalispell Creek								
Screened first year	100	24.4	100	14.2 1/	100	13.7	99	13.4
Unscreened	27	1.7	24	1.5	23	1.5	23	1.4
Ellis Creek								
Screened first year	100	11.2	67	5.1	58	4.9		
Unscreened after germination count	99	11.0	1	4.0	1	3.0		
Ninemile Creek								
Screened first year	91	2.9	82	2.7				
Unscreened after germination count	86	2.9	59	2.6				
Bimerick Creek								
Screened first year	94	9.0	91	7.8				
Unscreened, poisoned	75	3.8	14	3.2				

1/ Spots containing more than 15 seedlings were thinned in June of the first growing season so that no spots had more than 15 seedlings each.

One or more seeds germinated in all the 225 spots on Ellis Creek. Although stocking at the end of the first growing season was 67 percent on 112 spots which had been screened during the summer, the 113 spots unscreened during that period were failures. Within 3 weeks after the screens were removed in the spring the tops of practically all seedlings in unscreened spots were cut off apparently by mice. Loss of seedlings in screened spots resulted mainly from summer drought during both the first and second years. Rodents did not damage the seedlings after they became woody. This test indicates that on some areas where rodents are numerous screens are valuable not only to prevent the seeds from being eaten but also to protect the succulent seedlings from being consumed.

Rodent damage to unscreened seedlings was less serious on the Ninemile Creek plots. At the end of the first growing season 59 percent of the spots which had no screens during the summer contained one or more seedlings. Spots protected by 6-mesh screens were 82 percent stocked at the end of the first year. Losses of unscreened seedlings were as follows: 15 percent clipped or cut by rodents, insects, or cattle, 6 percent drought, 2 percent trampled by cattle, 1 percent damping off, and 15 percent missing or lost by unknown causes. Losses of seedlings under screens were 2 percent each from drought, trampling by cattle, cutting by insects, and damping off, and 8 percent missing or lost by unknown causes. Although they served several purposes, screens on this site during 1941 were chiefly valuable in reducing drought and cutting losses. It should be noted that 1941 was a favorable year with above-average moisture.

The Bimerick Creek seeding of ponderosa pine using poisons for rodent control was unsuccessful. Failure is believed to be due principally to grasshoppers which fatally injured or consumed the new seedlings. On check spots under screens germination and survival were very good, but on unprotected spots first-year survival was only 14 percent. At the time of first examination in the spring, 56 percent of the 225 unscreened sample spots had one or more live seedlings, but in addition 39 percent more of the spots contained dead seedlings which indicated a total germination in at least 75 percent of the spots. Because satisfactory germination did occur, it seems that the poisoning was successful in preventing excessive rodent depredations of the seeds. Seedlings on 42 percent or more of the unscreened sample spots were killed by actual destruction of or severe damage to the cotyledons and hypocotyls. Thousands of grasshoppers inhabited the area and some were found feeding on pine seedlings. From several specimens sent to him, Dr. Shull, entomologist at the University of Idaho, reported that the grasshoppers examined were nymphs of either the warrior grasshopper (Camnula pellucida) or the lesser migratory grasshopper (Melanoplus mexicanus). Histologic examinations by Dr. Ehrlich, forest pathologist at the University of Idaho, of sections of injured seedling tissues disclosed no signs of fungus mycelium or spores. From the frequency and type of seedling damage, typical of grasshopper work, the appearance of the lesions which suggested chewing, and the multitude of grasshoppers, some of which were observed chewing seedlings, the conclusion was drawn that grasshoppers were the principal cause of failure on the Bimerick Creek seeding project. Very little grasshopper damage occurred under screens because the screens could not be penetrated readily by these insects.

Summary

Ponderosa pine direct seeding was successful in four trials when the seed spots were protected with conical wire screens during the first growing season. When the seeds were unprotected from rodents, failure resulted. In two tests seed spots were screened from the time of seeding in the fall until after germination occurred in the spring. In one of these, subsequent survival the first year was satisfactory but less than for spots screened throughout the year. In the other, seedlings were destroyed by animals soon after the screens were removed. On some sites, therefore, screening after germination occurs is an advantage to protect the young seedlings from animals and excessive heat and to reduce transpiration and soil drying. On one area poisoning instead of screens to control seed-eating rodents was not enough to permit satisfactory stocking because the seedlings were destroyed apparently by grasshoppers. On a good site in an average year when grasshoppers are not numerous, it seems reasonable to expect that poisoning and seeding properly done will result in satisfactory stocking at a cost less than planting. With experience and improved methods the cost of seeding probably can be reduced significantly.